SURVEY METHODS FOR THE AMERICAN BURYING BEETLE (NICROPHORUS AMERICANUS) IN OKLAHOMA AND ARKANSAS

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Introduction

The American burying beetle (*Nicrophorus americanus*) is the largest member of the genus *Nicrophorus* in North America. It ranges from 1 to 1.5 inches (25-45 mm) in length. Like most other burying beetles, the American burying beetle has four red-orange spots on its wing covers (elytra). It can be distinguished from other North American burying beetles by its larger size and its orange-red pronotum and frons (see Figure 1).

The disappearance of the American burying beetle from over 90 percent of its historic range underscores the need for consistent, reliable methods when surveys for the beetle are conducted (U.S. Fish and Wildlife Service, 1991). The methods outlined below have proven to be successful in capturing the American burying beetle. Following these methods should help to ensure the validity of survey results. Furthermore, data gathered using these methods will allow for easier comparison of results from different surveys.

Site Selection

American burying beetles are generalists, occurring in many different habitats. Therefore, surveys should be conducted in a broad range of habitats. In addition, individual beetles have been recorded moving over 4 miles (6.5 km) in only a few days. For this reason, there is no need to locate survey sites less than one-half mile (0.8 km) apart. If large areas are being surveyed, sites can be located as much as one mile (1.6 km) apart. Individual sites should be trapped for three nights.

Trapping Methods

Baited pitfall traps are the most effective method known for surveying for American burying beetles. At each site, eight pitfall traps are placed at 20-m intervals along a transect line (Figure 2).

Each pitfall trap consists of two, 24-oz. (0.7-L) plastic cups stacked together and buried in the ground so that the lip of the top cup is flush with the soil surface (Figure 3). A plastic dome should be placed over each trap to keep out rain. A 10 x 10 inch (25 x 25 cm) piece of wood (held above the pitfall trap with 6-inch [15 cm] legs made of wooden dowls) can be substituted for a dome if one is not available. The bait is placed in the bottom of a 6-oz. (0.2-L) styro-foam cup that has had all but the bottom inch (2.5 cm) of the cup trimmed away. The trimmed-down sytro-foam cup is suspended above the plastic cups with a short length of wire (see Figure 3).

In this way, beetles do not have direct access to the bait when they are captured. Traps should be placed in the field before 17:00 DST and checked each morning before 10:00 DST to avoid beetle mortality due to excessive heat.

Unskinned chicken is the preferred bait. It is inexpensive and remains moist longer than other baits because most of its fat is in the skin. Approximately 0.5-0.6 oz. (15-20 g) of chicken is placed in each pitfall trap.

Fresh bait is not an effective attractant of any burying beetle. To prepare the chicken for use, chop it up into small cubes (0.5-0.6 oz. [15-20 g] apiece) and then place the cubes into a plastic jar. Do not fill the jar completely. The jar should then be sealed and allowed to sit in the sun for a minimum of one day. If the day is relatively cool (less than 85° F [29° C]), the bait should sit in the sun for a longer period of time.

The numbers of each sex of American burying beetles captured at each site should be recorded. The sexes can be separated based on orange-red markings located between the frons and mandibles: these markings are rectangular on males and triangular on females (see Figure 4).

The number of newly eclosed and reproductive adults also should be recorded. Adults that have recently (less than two weeks) pupated are known as newly eclosed. They can be distinguished from the previous year's young by their softer bodies and more shiny appearance. The red-orange pronotum appears to be lighter and more orange in color in newly eclosed adults. Older adults are often missing body parts, especially legs or antennae. In addition, the mandibles of older adults appear to be a bit more worn at the tip.

The numbers of individuals of other burying beetle species captured should be recorded. A written description of the burying beetle species found in eastern Oklahoma is presented in Table 1. An identification key is found in Table 2.

If a pitfall trap is disturbed prior to being checked in the morning, it should be noted whether the trap was: intact but with bait missing; or dug up by a mammal. The chicken should always be replaced if it is taken during the night or becomes dry. A sample survey form is included in the appendix.

Surveys for the American burying beetle should not be initiated until there has been a week where minimum temperatures have been consistently above 60° F (15° C). In Oklahoma and Arkansas, we conduct surveys between mid-May and late August. American burying beetle activity is influenced by weather conditions. For each night that the ambient temperature

dropsbelow 60° F (15° C) during the sampling period, the site should be sampled for another night. The site also should be retrapped if rainfall is heavy after dusk.

Marking Beetles

All American burying beetles captured need to be given a permanent mark by taking an eighth inch (3 mm), V-shaped clip out of the distal end of an elytron using small dissecting scissors. If a particular study requires the identification of individuals, a bee tag (from Chr. Graze KG, 7056 Weinstadt, Germany) is also used. These tags are approximately 1-mm in diameter, have individual numbers on them, and come in a variety of colors. The tag is glued to the proximal end of one elytron with gel Super Glue. The beetle should be placed in a dry, clean tub until the glue is dry. Prior to releasing the beetle, the surveyor should make sure the beetle can still spread its wings. Individual marking is a time-consuming and delicate process and should be done only if specific information on individual beetles is required. Otherwise, wing clipping should suffice for most surveys. Recaptures of beetles are recorded but not included in the total number of new American burying beetles captured.

It is usually easier to mark beetles at the vehicle instead of along the transect line. However, all marked beetles should be released along the transect line. When transporting beetles, the investigator should take care to keep the beetles in a well ventilated, non-breakable container. We use a one-gallon (3.8-L) plastic container with a wire-mesh cover held in place with a mason jar lid. Excess heat or overcrowding in the holding container can cause death of a beetle. Care should be taken not to allow beetles to become too crowded (no more than 10 beetles per container) or to have them overheat in the holding container. If a large number of beetles need to be marked, they can be placed in a container on ice in a cooler until they are marked or released. The beetles should not be held for more than one-half hour before being released.

Accidental Death of Beetles

The handling of all endangered species is strictly regulated by the United States Fish and Wildlife Service. When surveying for American burying beetles, a copy of the federal permit should be in your possession at all times. The handling of dead American burying beetles also is under strict regulation. They cannot be added to a private collection and only the United

States Fish and Wildlife Service is authorized to determine the proper disposition of beetles killed during surveys.

All American burying beetles killed during surveys need to be accounted for and an accidental-death form needs to be filled out as quickly as possible (see sample form in the appendix). The following information is to be noted:

(1) date beetle found dead;
(2) county, state, legal description (township and range) and any other information concerning location (i.e. trap number, site number or survey name);
(3) general habitat;
(4) as accurately as possible, the cause of death (previously, causes of death have included heat exposure, predation, and drowning);
(5) sex and age of beetle (whether it is a newly eclosed or reproductive age adult);
(6) name of individual that found beetle.

At a later time, the master permittee will note where the beetle was deposited. If the specimen cannot be prepared immediately, it should be placed in a sealable, rigid plastic container so the beetle is not crushed. To avoid mixing up specimens, no more than one beetle should be kept in a container. Each accidental-death form has a specimen number. A copy of this number should be placed in the container with the beetle so specimens do not become mixed up. The container should then be put on ice until the beetle can be prepared. Specimens are to be placed in the care of the field supervisor and then reported to the United States Fish and Wildlife Service as soon as possible.

Recording Habitat Variables

Habitat data are collected at all sites surveyed for the American burying beetle, including sites where American burying beetles were not captured. Each transect has seven habitat sampling stations with one station half-way between each pair of adjacent pitfall traps (traps are 20 m apart). Figure 2 illustrates where the sampling stations are located along the survey transect and lists data to be collected at each station. A sample habitat-data form is found in the appendix.

A habitat-sampling station is considered to be the area within a 0.5 x 0.5 m wooden frame placed on the ground. The investigator notes the presence of grasses, herbs, mosses, rocks, leaf litter, shrubs less than or equal to 2 m in height, shrubs greater than 2 m in height and woody

vegetation with dbh (diameter breast height) greater than 10 cm at each of the seven sampling stations.

Percent of canopy closure (to nearest percent), soil depth (in decameters), and a soil sample should be taken at stations 1, 4, and 7. Canopy closure is measured with a spherical densiometer (concave Model C, Forestry Suppliers, Inc., Jackson, Mississippi). The procedure follows Lemmon (1957) and is outlined on the inside cover of the densiometer (copy is included as Appendix 2). A soil sampler (Oakfield Apparatus Co., 19" tube sampler, Forestry Supplier, Inc., Jackson, Mississippi) is used to measure the depth of the soil, as well as to collect the soil sample. The three soil samples from each site are placed in a single spunbound olefin sampling bag (4.5 x 6 inch [11 x 15 cm, Ben Meadows Co., Atlanta, Georgia]) with the number of the survey site recorded on the bag.

The remaining data should be collected at station 4 only. The slope of the terrain is measured with an Suunto optical reading clinometer (Model PM-5-360 PC, Forestry Suppliers, Inc., Jackson Mississippi), and the slope's aspect is measured with a compass (in degrees from magnetic north). The distance to the nearest forest edge (recorded in grassland sites) or to edge of an open area (recorded in forested sites) is measured in meters with a rangefinder (Ranging Measuring Systems, Model 620, Forestry Suppliers, Inc., Jackson, Mississippi). At a site with scattered trees and open areas (such as a savannah), the distance is recorded as zero.

Reporting of Survey Results

The results of surveys for American burying beetles are sent to the United States Fish and Wildlife Service in Tulsa, Oklahoma and the Oklahoma Natural Heritage Inventory (Oklahoma Biological Survey) in Norman, Oklahoma.

References

Lemmon, P. E. 1957. A new instrument for measuring forest overstory density. J. Forestry 55:667-668.

U.S. Fish and Wildlife Service. 1991. American burying beetle recovery plan. U.S. Fish and Wildlife Service, Newton Corner, Massachusetts.